



**Fraunhofer**  
IMS

Fraunhofer Institute for Micro-  
electronic Circuits and Systems IMS

MEDICAL  
CARE



HEALTH



# Business Unit Health

Smart Sensor Systems for  
Medical Applications



## Business Unit Health

We develop smart biomedical sensor systems for **medical implants, in-situ diagnostics** and **non-invasive healthcare** applications. These are specifically tailored to the requirements of the target application in the fields of medicine, life science, biotechnology, food, pharmaceutical and environmental technology. Smart sensors detect health-relevant information in non-contact manner as wearable, medical implant or diagnostic device with high sensitivity. They provide diagnostic support, suggest preventive measures and initiate targeted therapies.

## Fraunhofer IMS

**Smart Sensor Systems for a safe, secure, and sustainable future:** In numerous state-of-the-art research laboratories, Fraunhofer IMS works with more than 250 talented scientific employees and students on innovative microelectronic solutions. As a trusted research and development partner for industry, the institutes' goal is to develop customized sensor systems for your specific needs in the areas of biomedical sensors, optical systems, open source semiconductors, embedded AI, technology services, and even quantum technology.

The teams in the four business units – Health, Industry, Mobility, and Space and Security – are committed to implementing outstanding and versatile microelectronics that can be utilized across all your projects. For example, these solutions feature high integration capability, enormous energy efficiency and reliable functionality even under harsh conditions.

## Medical Implants

At Fraunhofer IMS, the next generations of intelligent implants are developed. The implants record the patients' vital signs and can initiate therapeutic interventions in a closed loop control to improve the patients' health. Continuous miniaturization of medical implants is a trend that opens up previously unfeasible new applications. In addition, optimized overall performance can be achieved for existing applications through increased functionality.

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### Reference Projects

Implantable sensor systems for long-term monitoring of intracranial and intraocular pressure have been developed and received CE certification.

### Our Offer for Medical Implants:

- Physical or biochemical sensors
- Actuators as stimulation electronics and electrodes
- Energy-efficient electronics
- Embedded AI processing of sensor data
- Secure communication
- Biostable encapsulation by thin film deposition

## In-situ Diagnostics

We develop biosensor systems for sensitive and specific detection of enzymes, proteins, DNA or other biomolecules and integrate them into lab-on-chips (LoC). Our focus lies on bio-functionalized nanomaterials, such as carbon nanotubes, for multiplex diagnostic applications. Furthermore, we focus on CMOS-based single-photon imagers, single-photon avalanche diode (SPAD) arrays, to detect low light intensities like in chemiluminescence reactions and fluorescence lifetimes. A third focus is on MEMS-based 3D hollow nanoelectrodes fabricated by atomic layer deposition (ALD) for intracellular electrophysiology. Combined with microfluidics, the nanoelectrodes can be used for drug delivery at single cell level.



### Reference Projects

Together with partners, we have successfully developed biosensors for SARS-COV2 detection and for online monitoring in pharmaceutical production.

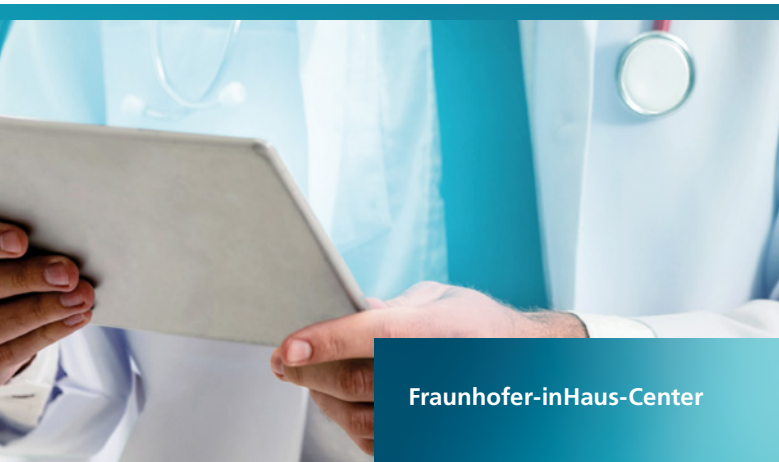
### Application Fields

- Multiplex diagnostic testing
- Food and environmental monitoring
- Automated pharmaceutical production
- Molecular imaging and single cell electrophysiology

## Non-invasive Healthcare

We develop intelligent sensor assistance systems that record and directly evaluate human vital parameters. They can be realized both in a contactless manner or worn as patch on the body. In this way, new applications in hospital, nursing and in everyday life are made possible.

Vital parameters, such as heart frequency, respiration rate, oxygen saturation and blood pressure, are measured using standard optical cameras and quantified accurately by machine learning methods. The next generation of smart and energy-sufficient sensor patches is enabled by embedded AI for signal analysis.



### Reference Projects

We have developed a semiconductor-chip with embedded AI detecting heart diseases, a body-scale with calibration-free detection of blood pressure and contactless vital parameter detection in a care robot.

### Fraunhofer-inHaus-Center

Its unique Living Lab with hospital engineering and intelligent care room enables user experience-based development and evaluation of novel assistance systems.

## Contact

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